JC03 Rec'd PCT/PTO 24 AUG 2001

°FORM PTO-1390 (REV 11-2000) U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. § 371

ATTORNEY'S DOCKET NUMBER: 449122008400

U.S. APPLICATION NO. (If known, see 37 CFR 1.5): 09/914153 Not yet assigned

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE00/00316	02 February 2000	24 February 1999

TITLE OF INVENTION

METHOD FOR DETERMINING A COMMUNICATION PATH IN A COMMUNICATION NETWORK BETWEEN TWO NEIGHBORING NETWORK NODES

APPLICANT(S) FOR DO/EO/US

Clemens HAUBER

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☒ The US has been elected by the expiration of 19 months from the priority date (PCT Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☒ is attached hereto (required only if not communicated by the International Bureau).
   b. ☐ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application under PCT Article 19 (35 U.S.C. 371(c)(2)).
   a. ☒ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).
   a. ☒ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
8. ☒ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
14. ☐ A SECOND or SUBSEQUENT preliminary amendment.
15. ☐ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☒ Other items or information: 1) IPER; 2) In'tl Search Report; 3) Application Data Sheet; 4) Return receipt postcard.

CERTIFICATE OF HAND DELIVERY

I hereby certify that this correspondence is being hand filed with the United States Patent and Trademark Office in Washington, D.C. on August 24, 2001.

R. Lynn Boyden

dc-277038

U.S. APPLICATION NO (if known, see 37 CFR 1.5) Not yet assigned 09/914153	INTERNATIONAL APPLICATION NO. PCT/DE00/00316	ATTORNEY'S DOCKET NUMBER: 449122008400

21. ☒ The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)):

Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO.....$1,000.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO.....$860.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO.....$710.00

International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provision of PCT Article 33(1)-(4) $690.00

International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) $100.00

	CALCULATIONS PTO USE ONLY	
ENTER APPROPRIATE BASIC FEE AMOUNT =	$860.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$0	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	5 - 20 =	0	x $18.00	$0	
Independent claims	1 - 3 =	0	x $80.00	$0	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ $270.00	$0	
TOTAL OF ABOVE CALCULATIONS =				$860.00	
☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by ½.				$0	
SUBTOTAL =				$860.00	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$0	
TOTAL NATIONAL FEE =				$860.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00 per property** +				$40.00	
TOTAL FEES ENCLOSED =				$900.00	
				Amount to be refunded:	**$**
				charged:	**$**

a. ☒ Please charge my **Deposit Account No. 03-1952** in the amount of $900.00 to cover the above fees. A duplicate copy of this sheet is enclosed.

b. ☒ The Commissioner is hereby authorized to charge any additional fees that may be required, or credit any overpayment to **Deposit Account No. 03-1952**.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Kevin R. Spivak
Morrison & Foerster LLP
2000 Pennsylvania Avenue, N.W.
Washington, D.C. 20006-1888

SIGNATURE

Kevin R. Spivak
Registration No. 43,148

PATENT
Docket No. 449122008400

CERTIFICATE OF HAND DELIVERY

I hereby certify that this correspondence is being hand filed with the United States Patent and Trademark Office in Washington, D.C. on August 24, 2001.

R. Lynn Boyden

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the application of:

Clemens HAUBER

Serial No.: Not yet assigned

Filing Date: August 24, 2001

For: METHOD FOR DETERMINING A COMMUNICATION PATH IN A COMMUNICATION NETWORK BETWEEN TWO NEIGHBORING NETWORK NODES

Examiner: Not yet assigned

Group Art Unit: Not yet assigned

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Prior to examination on the merits, please amend this application as follows:

In the Specification:

Page 1 before the first paragraph, please delete the following:

~~Description~~

The title has been amended as follows:

METHOD FOR TRANSMITTING DATA VIA A TRACTION CURRENT CONDUCTOR WHICH CONDUCTS AN ELECTRICAL DRIVE CURRENT FOR VEHICLES

On page 1, please delete lines 7 and 8.

Page 1, between lines 8 and 9 has been amended to include the following:

CLAIM FOR PRIORITY

This application claims priority to International Application No. PCT/DE00/00316 which was published in the German language on August 31, 2000.

TECHNICAL FIELD OF THE INVENTION

The invention relates to a method for determining a communication path, and in particular, to determining a communication path in a network between network nodes.

BACKGROUND OF THE INVENTION

Please replace the paragraph beginning on page 1, line 13, with the following rewritten paragraph:

In contemporary communication networks, different traffic mixtures are conducted via the communication paths arranged between two or more network nodes. Thus, for example, information can be transmitted by a synchronous transfer mode (STM) or asynchronous mode (ATM). In this context, the information can have different bandwidths. Thus, as a rule, a distinction is made between information which is transmitted as narrowband signals and that which is transmitted as wideband or broadband signals. Thus, special significance is attached to setting up a connection between two neighboring network nodes, i.e. those connected to one another via one trunk group.

Please replace the paragraph beginning on page 2, line 9, with the following rewritten paragraph:

Hunting strategy methods are disclosed in "Probability of Loss of Data Traffics with different Bit Rates Hunting One Common PCM Channel", Proceedings of the 8th International Teletraffic Congress (ITC 8), 1976, pp. 525.1 - 525.8, Lothar Katzschner and Reinhard Scheller.

Please replace the paragraph beginning on page 3, line 3, with the following rewritten paragraph:

The disadvantage of such a procedure is that it results in a non-uniform load distribution on the trunk group. The reason for this is that the hunt is always started from the same position and is terminated when a suitable trunk has been found. On average, therefore, the trunks which have been hunted first are used to high capacity whereas the remaining trunks are used to low capacity ("unbalanced load").

Please replace the paragraph beginning on page 3, line 29, with the following rewritten paragraph:

Although this prevents the disadvantage of the first hunting strategy method (nonuniform load distribution) because of the variable position which, on average, provides a more or less uniform distribution on the trunk. The disadvantage of such a procedure is, however, because of the uniform load distribution, high-bit-rate connections can no longer be accommodated it with greater probability because of the lack of trunks with low capacity utilization and a corresponding request for connection setup must then be rejected.

Page 4, between lines 31 and 32, has been amended to include the following:

SUMMARY OF THE INVENTION

In one embodiment of the invention, there is a method for determining a communication path in a communication network which includes, for example, conducting a plurality of connections via a corresponding plurality of trunks between two neighboring network nodes and which reserve transmission capacities on the trunks, and determining the trunk using an algorithm on which the connection is accommodated in accordance with an acceptance criterion wherein at least one additional connection is accommodated on one of the trunks, wherein according to a bit rate threshold value, the algorithm begins from a fixed reference point when the peak bit rate of the connection to be accepted is greater than the bit rate threshold value, or begins from a variable reference point when the peak bit rate of the connection to be accepted is less than the bit rate threshold value or equal to the bit rate threshold value, and the algorithm is applied to the plurality of trunks until a trunk having sufficient free transmission capacity is

found and the connection is accepted or all trunks have been checked and the connection is rejected.

In one aspect of the invention, the fixed reference point is the first trunk in the plurality of trunks.

In another aspect of the invention, the variable reference point is the trunk in the plurality of trunks which, in cyclic rotation, is arranged immediately following the trunk at which the algorithm started from a variable reference point has been terminated the last time previously.

In yet another aspect of the invention, the free residual transmission capacity ($C_r(T_i)$) of ~~a~~ one of the trunks is obtained from a physical transmission capacity of the trunk, and the capacity is reduced by the sum of the peak bit rates of the currently active connections of the trunk.

In still another aspect of the invention, the acceptance criterion is designed in such a manner that a check is made whether the freely available residual transmission capacity $C_r(T_i)$ is greater than or equal to the peak bit rate of the connection.

BRIEF DESCRIPTION OF THE DRAWINGS

In the text which follows, the invention will be explained in greater detail with reference to an exemplary embodiment shown in the figures, in which:

Figure 1 shows an exemplary configuration in which the method according to the invention is run.

Figure 2 shows an exemplary algorithm according to the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Please replace the paragraph beginning on page 4, line 32, with the following rewritten paragraph:

The invention discloses an approach of how communication paths in a communication network can also be determined with inhomogeneous traffic.

On page 5, please delete lines 1-4.

Please replace the paragraph beginning on page 5, line 5, with the following rewritten paragraph:

An advantageous factor of the invention is, in particular, the provision of a bit rate threshold value. According to this threshold value, a decision is made as to which hunting strategy method is applied to the trunks.

On page 5, please delete lines 10-15.

Please replace the paragraph beginning on page 5, line 17, with the following rewritten paragraph:

Figure 1 shows a communication network. In this arrangement, four network nodes N_1 ... N_4 are shown. Of course, more or less network nodes could be used. Two network nodes, for example network nodes N_1, N_4, are connected to one another via a trunk TG. In the trunk group TG, a plurality of trunks T_1 ... T_n are arranged. Each of the trunks T_1 ... T_n has a specified transmission capacity C_s as physical transmission parameter. The residual transmission capacity $C_r(T_i)$ (i=1...n) freely available for further connections is obtained from the physical connection capacity C_s minus the sum of the peak bit rates R_{pj} of the m connections (j=1, 2...,m) currently conducted via this capacity.

Please replace the paragraph beginning on page 6, line 8, with the following rewritten paragraph:

For this purpose, the two known hunting algorithms, called hunting strategy methods in the text which follows, are combined. First, a criterion is established for determining which one of the known hunting strategy methods will be run. The criterion provided is a bit rate threshold value which can be arbitrarily predetermined but should usually be of the order of magnitude 1/10 C_s...1/5 C_s. First, it is decided whether the peak bit rate R_p of the connection newly to be accepted is greater than or less than this bit rate threshold value.

Please replace the paragraph beginning on page 6, line 25, with the following rewritten paragraph:

The hunting process is thus started with the first trunk in the trunk group. Which one of the trunks is the first one can be freely defined. The new connection V to be accommodated is accepted if a trunk T_i is found, the freely available residual transmission capacity $C_r(T_i)$ of which is greater than or equal to the peak bit rate R_{pV} of this connection. In this process, the trunks in the trunk group are checked successively. Once a suitable trunk has been found, this trunk is taken and the hunting is terminated. If no free transmission capacity is found by the last trunk, the connection in question is rejected. If a further connection V' is provided for acceptance at a later time, another hunt is started. This will be started again at the first trunk if the peak bit rate $R_{pV'}$ of the connection to be newly accepted is greater than the bit rate threshold value.

On page 9, please replace "Patent Claims" with --WHAT IS CLAIMED IS--

In the Claims:

1. (Amended) A method for determining a communication path in a communication network, comprising:

conducting a plurality of connections via a corresponding plurality of trunks between two neighboring network nodes and which reserve transmission capacities on the trunks; and

determining the trunk using an algorithm on which the connection is accommodated in accordance with an acceptance criterion wherein at least one additional connection is accommodated on one of the trunks, wherein

according to a bit rate threshold value, the algorithm begins from a fixed reference point when the peak bit rate of the connection to be accepted is greater than the bit rate threshold value, or begins from a variable reference point when the peak bit rate of the connection to be accepted is less than the bit rate threshold value or equal to the bit rate threshold value, and the algorithm is applied to the plurality of trunks until a trunk having sufficient free transmission capacity is found and the connection is accepted or all trunks have been checked and the connection is rejected.

2. (Amended) The method as claimed in claim 1, wherein the fixed reference point is the first trunk in the plurality of trunks.

3. (Amended) The method as claimed in claim 1, wherein the variable reference point is the trunk in the plurality of trunks which, in cyclic rotation, is arranged immediately following the trunk at which the algorithm started from a variable reference point has been terminated the last time previously.

4. (Amended) The method as claimed in claim 1, wherein the free residual transmission capacity ($C_r(T_i)$) of a one of the trunks is obtained from a physical transmission capacity of the trunk, and the capacity is reduced by the sum of the peak bit rates of the currently active connections of the trunk.

5. (Amended) The method as claimed in claim 1, wherein the acceptance criterion is designed in such a manner that a check is made whether the freely available residual transmission capacity $C_r(T_i)$ is greater than or equal to the peak bit rate of the connection.

In the Abstract:

Please replace the Abstract in its entirety with the Abstract attached hereto.

REMARKS

The above amendments to the specification, claims and abstract have been made to place the application in proper U.S. format and to conform with proper grammatical and idiomatic English. None of the amendments herein are made for reasons related to patentability. No new matter has been added.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "**Version with markings to show changes made**".

In the event that the transmittal letter is separated from this document and the Patent Office determines that an extension and/or other relief is required, applicant petitions for any required relief including extensions of time and authorizes the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to **Deposit Account No. 03-1952** referencing docket no. 449122008400. However, the Commissioner is not authorized to charge the cost of the issue fee to the Deposit Account.

Respectfully submitted,

Dated: August 24, 2001

By: [signature]

Kevin R. Spivak
Registration No. 43,148

Morrison & Foerster LLP
2000 Pennsylvania Avenue, N.W.
Washington, D.C. 20006-1888
Telephone: (202) 887-6924
Facsimile: (202) 263-8396

VERSION WITH MARKINGS TO SHOW CHANGES MADE

For the convenience of the Examiner, the changes made are shown below with deleted text in strikethrough and added text in underline.

In the Specification:

Page 1 before the first paragraph, please delete the following:

~~Description~~

The title has been amended as follows:

METHOD FOR TRANSMITTING DATA VIA A TRACTION CURRENT CONDUCTOR WHICH CONDUCTS AN ELECTRICAL DRIVE CURRENT FOR VEHICLES .

On page 1, please delete lines 7 and 8:

~~The invention relates to a method according to the preamble of patent claim 1.~~

Page 1, between lines 8 and 9 has been amended to include the following:

CLAIM FOR PRIORITY

This application claims priority to International Application No. PCT/DE00/00316 which was published in the German language on August 31, 2000.

TECHNICAL FIELD OF THE INVENTION

The invention relates to a method for determining a communication path, and in particular, to determining a communication path in a network between network nodes.

BACKGROUND OF THE INVENTION

Paragraph beginning on line 13 of page 1 has been amended as follows:

In contemporary communication networks, different traffic mixtures are conducted via the communication paths arranged between two or more network nodes. Thus, for example, information can be transmitted by ~~means of~~ a synchronous transfer mode (STM) or asynchronous mode (ATM). In this context, the information can have different bandwidths.

Thus, as a rule, a distinction is made between information which is transmitted as narrowband signals and that which is transmitted as wideband or broadband signals. Thus, special significance is attached to setting up a connection between two neighboring network nodes, i.e. those connected to one another via one trunk group.

Paragraph beginning on line 9 of page 2 has been amended as follows:

Hunting strategy methods are ~~known from the printed document~~ disclosed in "Probability of Loss of Data Traffics with different Bit Rates Hunting One Common PCM Channel", Proceedings of the 8th International Teletraffic Congress (ITC 8), 1976, pp. 525.1 - 525.8, Lothar Katzschner and Reinhard Scheller.

Paragraph beginning on line 3 of page 3 has been amended as follows:

The disadvantage~~ous factor~~ of such a procedure is that it results in a non-uniform load distribution on the trunk group. The reason for this is that the hunt is always started from the same position and is terminated when a suitable trunk has been found. On average, therefore, the trunks which have been hunted first are used to high capacity whereas the remaining trunks are used to low capacity ("unbalanced load").

Paragraph beginning on line 29 of page 3 has been amended as follows:

Although this prevents the disadvantage of the first hunting strategy method (nonuniform load distribution) because of the variable position which, on average, provides a more or less uniform distribution on the trunk. The disadvantage of such a procedure is, however, ~~that,~~ because of the uniform load distribution, high-bit-rate connections can no longer be accommodated it with greater probability because of the lack of trunks with low capacity utilization and a corresponding request for connection setup must then be rejected.

Page 4, between lines 31 and 32, has been amended to include the following:

SUMMARY OF THE INVENTION

In one embodiment of the invention, there is a method for determining a communication path in a communication network which includes, for example, conducting a plurality of connections via a corresponding plurality of trunks between two neighboring network nodes and which reserve transmission capacities on the trunks, and determining the trunk using an

algorithm on which the connection is accommodated in accordance with an acceptance criterion wherein at least one additional connection is accommodated on one of the trunks, wherein according to a bit rate threshold value, the algorithm begins from a fixed reference point when the peak bit rate of the connection to be accepted is greater than the bit rate threshold value, or begins from a variable reference point when the peak bit rate of the connection to be accepted is less than the bit rate threshold value or equal to the bit rate threshold value, and the algorithm is applied to the plurality of trunks until a trunk having sufficient free transmission capacity is found and the connection is accepted or all trunks have been checked and the connection is rejected.

In one aspect of the invention, the fixed reference point is the first trunk in the plurality of trunks.

In another aspect of the invention, the variable reference point is the trunk in the plurality of trunks which, in cyclic rotation, is arranged immediately following the trunk at which the algorithm started from a variable reference point has been terminated the last time previously.

In yet another aspect of the invention, the free residual transmission capacity ($C_r(T_i)$) of ~~a~~ one of the trunks is obtained from a physical transmission capacity of the trunk, and the capacity is reduced by the sum of the peak bit rates of the currently active connections of the trunk.

In still another aspect of the invention, the acceptance criterion is designed in such a manner that a check is made whether the freely available residual transmission capacity $C_r(T_i)$ is greater than or equal to the peak bit rate of the connection.

BRIEF DESCRIPTION OF THE DRAWINGS

In the text which follows, the invention will be explained in greater detail with reference to an exemplary embodiment shown in the figures, in which:

Figure 1 shows an exemplary configuration in which the method according to the invention is run.

Figure 2 shows an exemplary algorithm according to the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Paragraph beginning on line 32 of page 4 has been amended as follows:

The invention discloses ~~is based on the object of demonstrating~~ an approach of how communication paths in a communication network can also be determined with inhomogeneous traffic.

On page 5, please delete lines 1-4:

~~The object is achieved by the features specified in the characterizing clause on the basis of the features specified in the preamble of patent claim 1.~~

Paragraph beginning on line 5 of page 5 has been amended as follows:

~~The~~ An advantageous factor of the invention is, in particular, the provision of a bit rate threshold value. According to this threshold value, a decision is made as to which hunting strategy method is applied to the trunks.

On page 5, please delete lines 10-15:

~~Advantageous further developments of the invention are specified in the subclaims.~~

~~In the text which follows, the invention will be explained in greater detail with reference to an exemplary embodiment shown in the figures, in which:~~

~~Figure 1~~ ~~shows the configuration in which the method according to the~~

~~invention is run,~~

~~Figure 2~~ ~~shows the algorithm according to the invention.~~

Paragraph beginning on line 17 of page 5 has been amended as follows:

Figure 1 shows a communication network. In this arrangement, ~~only~~ four network nodes $N_1 \ldots N_4$ are shown ~~for the sake of simplicity~~. Of course, more or less network nodes could be used. Two network nodes, for example network nodes N_1, N_4, are connected to one another via a trunk TG. In the trunk group TG, a plurality of trunks $T_1 \ldots T_n$ are arranged. Each of the trunks $T_1 \ldots T_n$ has a specified transmission capacity C_s as physical transmission parameter. The residual transmission capacity $C_r(T_i)$ (i=1...n) freely available for further connections is obtained from the physical connection capacity C_s minus the sum of the peak bit rates R_{pj} of the m connections (j=1, 2...,m) currently conducted via this capacity.

Paragraph beginning on line 8 of page 6 has been amended as follows:

For this purpose, the two known hunting algorithms, called hunting strategy methods in the text which follows, are combined. Firstly, a criterion is established for determining ~~when~~ which one of the known hunting strategy methods will be run. The criterion provided is a bit rate threshold value which can be arbitrarily predetermined but should usually be of the order of magnitude 1/10 C_s...1/5 C_s. Firstly, it is decided ~~in a first step~~ whether the peak bit rate R_p of the connection newly to be accepted is greater than or less than this bit rate threshold value.

Paragraph beginning on line 25 of page 6 has been amended as follows:

The hunting process is thus started with the first trunk in the trunk group. Which one of the trunks is the first one can be freely defined. The new connection V to be accommodated is accepted if a trunk T_i is found, the freely available residual transmission capacity $C_r(T_i)$ of which is greater than or equal to the peak bit rate R_{pV} of this connection. In this process, the trunks in the trunk group are checked successively ~~step by step~~. Once a suitable trunk has been found, this trunk is taken and the hunting is terminated. If no free transmission capacity is found by the last trunk, the connection in question is rejected. If a further connection V' is provided for acceptance at a later time, another hunt is started. This will ~~only~~ be started again at the first trunk if the peak bit rate $R_{pV'}$ of the connection to be newly accepted is greater than the bit rate threshold value.

On page 9, please replace "Patent Claims" with --WHAT IS CLAIMED IS--

In the Claims:

1. (Amended) A method for determining a communication path in a communication network, comprising:

conducting a plurality of connections ~~which are in each case conducted~~ via a ~~further~~ corresponding plurality of trunks ~~(T_1...T_n)~~ between two neighboring network nodes ~~(N_1...N_4)~~ and which reserve transmission capacities on ~~these~~ the trunks ~~(T_1...T_n), and comprising~~ ; and

determining the trunk using an algorithm on which the connection is accommodated in accordance with an acceptance criterion wherein at least one ~~further~~ additional connection ~~(V) which~~ is ~~to be additionally~~ accommodated on one of the trunks ~~(T_1...T_n) in that a hunting algorithm determines the trunk (T_1...T_n) on which this connection (V) can still be accommodate in accordance with an acceptance criterion~~, wherein

~~characterized in that~~

according to a bit rate threshold value, the ~~hunting~~ algorithm ~~is started~~ begins from a fixed reference point when the peak bit rate ~~(R_{pV})~~ of the connection to be ~~newly~~ accepted is greater than the bit rate threshold value, or ~~is started~~ begins from a variable reference point when the peak bit rate ~~(R_{pV})~~ of the connection to be ~~newly~~ accepted is less than the bit rate threshold value or equal to the bit rate threshold value, and ~~thereafter~~ the ~~hunting~~ algorithm is applied ~~step by step~~ to the ~~further~~ plurality of trunks ~~(T_1...T_n)~~ until a trunk ~~(T_1...T_n)~~ having sufficient free transmission capacity is found and the connection is accepted or all trunks ~~(T_1...T_n)~~ have been checked and the connection ~~must be~~ is rejected.

2. (Amended) The method as claimed in claim 1, ~~characterized in that~~ wherein the fixed reference point is the first trunk ~~(T_1)~~ in the ~~trunk group (TG)~~ plurality of trunks.

3. (Amended) The method as claimed in claim 1, ~~characterized in that~~ wherein the variable reference point is the trunk ~~(T_i)~~ in the ~~trunk group (TG)~~ plurality of trunks which, in cyclic rotation, is arranged immediately following the trunk at which the ~~hunting~~ algorithm started from a variable reference point has been terminated the last time previously.

4. (Amended) The method as claimed in claim 1 ~~to 3~~, ~~characterized in that~~ wherein the free residual transmission capacity ($C_r(T_i)$) of ~~a~~ one of the trunks ~~(T_1...T_n)~~ is obtained from ~~the~~ a physical transmission capacity ~~(C_s)~~ of ~~this~~ the trunk, and ~~this amount~~ the capacity is reduced by the sum of the peak bit rates ~~(R_{pj})~~ of the currently active ~~m~~ connections ~~(j=1...m)~~ of ~~this~~ the trunk.

5. (Amended) The method as claimed in ~~one of the preceding claims, characterized in that~~ claim 1, wherein the acceptance criterion is designed in such a manner that a check is made

whether the freely available residual transmission capacity $C_r(T_i)$ is greater than or equal to the peak bit rate ~~(R_{pV})~~ of ~~this~~ the connection ~~(V)~~

In the Abstract:

Please replace the Abstract in its entirety with the Abstract attached hereto.

METHOD FOR DETERMINING A COMMUNICATION PATH IN A COMMUNICATION NETWORK BETWEEN TWO NEIGHBORING NETWORK NODES

Abstract

To allow a connection on a trunk group including of a number of trunks between two neighboring network nodes, a hunting algorithm determines the trunk on which the peak bit rate of this connection can still be accommodated. For this purpose, a bit rate threshold value is first used for deciding whether the hunting algorithm is started from a fixed reference point or from a variable reference point. The hunting algorithm is then applied to the trunks until a trunk having sufficient free transmission capacity is found or the connection is rejected..

Description 2/pats

Method for determining a communication path in a communication network between two neighboring network nodes.

The invention relates to a method according to the preamble of patent claim 1.

Contemporary communication networks have a plurality of network nodes which are intermeshed via communication paths. These are formed from a number of trunks which are combined to form trunk groups.

In contemporary communication networks, different traffic mixtures are conducted via the communication paths arranged between two or more network nodes. Thus, for example, information can be transmitted by means of a synchronous transfer mode (STM) or asynchronous mode (ATM). In this context, the information can have different bandwidths. Thus, as a rule, a distinction is made between information which is transmitted as narrowband signals and that which is transmitted as wideband or broadband signals. Thus, special significance is attached to setting up a connection between two neighboring network nodes, i.e. those connected to one another via one trunk group.

When setting up a connection, two decisions must be made, in general, for determining a communication path between two neighboring network nodes. On the one hand, it must be decided on which of the trunks of the trunk group connecting the network nodes in question sufficient capacity is still free in order to be able to establish a connection.

On the other hand, one of the communication paths which are conceivable with regard to the available capacity, must be selected in such a manner that

an optimum grade of service is obtained. This is necessary in as much as a selected communication path should ensure the lowest possible blocking probability and an associated low connection loss probability for subsequent connections.

A method by means of which both of these tasks (search and selection) can be performed is called a hunting strategy method or hunting strategy.

Hunting strategy methods are known from the printed document "Probability of Loss of Data Traffics with different Bit Rates Hunting One Common PCM Channel", Proceedings of the 8th International Teletraffic Congress (ITC 8), 1976, pp. 525.1 - 525.8, Lothar Katzschner and Reinhard Scheller.

Accordingly, a first hunting strategy method is described by means of which a sequential hunt is performed from a fixed zero position. In this process, the hunting always begins with the first trunk in the trunk group. Which one of the trunks is to be considered as the first one can be freely defined. The hunt is terminated as soon as a trunk has been found which meets the acceptance criteria. The acceptance criterion used here is the transmission capacity still available on the trunk in relation to the peak bit rate of the connection to be accommodated. The new connection to be accommodated will thus be accepted if a trunk is found the free available transmission capacity of which is greater than or equal to the peak bit rate of this connection. If this is so, the hunt is terminated. The next hunt is again started at the first trunk. If no free transmission capacity is found by the last trunk, the hunt

is also terminated and the connection is question is rejected.

The disadvantageous factor of such a procedure is that it results in a nonuniform load distribution on the trunk group. The reason for this is that the hunt is always started from the same position and is terminated when a suitable trunk has been found. On average, therefore, the trunks which have been hunted first are used to high capacity whereas the remaining trunks are used to low capacity ("unbalanced load").

According to this prior art, a second hunting strategy method is described by means of which a sequential hunt is performed from a variable zero position. In this process, the hunting begins with a specially marked trunk in the trunk group. The marking has been performed by the immediately preceding hunt. This defines the position at which the next hunt is to be started. The new connection to be accepted is accepted if a trunk is found, the freely available transmission capacity of which is greater than or equal to the peak bit rate of this connection. If this is so, the hunt is terminated. At the same time as this, the trunk immediately following is marked. The next hunt thus begins at this trunk. If no free transmission capacity is found by the last trunk, the connection in question will be rejected. The last trunk is defined as the trunk which immediately precedes the marked trunk after a cyclic rotation.

Although this prevents the disadvantage of the first hunting strategy method (nonuniform load distribution) because of the variable

position which, on average, provides a more or less uniform distribution on the trunk. The disadvantage of such a procedure is, however, that, because of the uniform load distribution, high-bit-rate connections can no longer be accommodated it with greater probability because of the lack of trunks with low capacity utilization and a corresponding request for connection setup must then be rejected.

These known methods were developed, in particular, for a homogeneous traffic characteristic in which each connection setup was associated with the same capacity requirement of 64 kbit/s per connection. However, this homogeneity of the traffic in connection setup is often no longer given in contemporary communication networks. Apart from the conventional narrowband connections with 64 kbit/s, for example, wideband connections with nx64 kbit/s occur (in the case of STM-based connection-oriented multiple-rate services) or even broadband connections with any bit rate granularity in the case of ATM traffic.

However, this results in completely new requirements for the connection setup. For example, the traffic handling capacity for all types of traffic must be, at the same time, as high and as rugged as possible with the least possible interaction. In the case of ATM traffic, this results in the requirement for the most even load distribution possible over all trunks of a trunk group. Otherwise, connections on trunks with high capacity utilization would be subject to greater delay in the associated queues than on trunks with low capacity utilization.

The invention is based on the object of demonstrating an approach of how communication paths in a communication network can also be determined with inhomogeneous traffic.

The object is achieved by the features specified in the characterizing clause on the basis of the features specified in the preamble of patent claim 1.

The advantageous factor of the invention is, in particular, the provision of a bit rate threshold value. According to this threshold value, a decision is made as to which hunting strategy method is applied to the trunks.

Advantageous further developments of the invention are specified in the subclaims.

In the text which follows, the invention will be explained in greater detail with reference to an exemplary embodiment shown in the figures, in which:

Figure 1 shows the configuration in which the method according to the invention is run,

Figure 2 shows the algorithm according to the invention.

Figure 1 shows a communication network. In this arrangement, only four network nodes N_1 ... N_4 are shown for the sake of simplicity. Two network nodes, for example network nodes N_1, N_4 are connected to one another via a trunk TG. In the trunk group TG, a plurality of trunks T_1 ... T_n are arranged. Each of the trunks T_1 ... T_n has a specified transmission capacity C_s as physical transmission parameter. The residual transmission capacity $C_r(T_i)$ (i=1...n) freely available for further connections is obtained from the physical connection capacity C_s minus the sum of the peak bit rates R_{pj} of the m connections (j=1, 2...,m) currently conducted via this capacity.

In the text which follows, it is assumed that a connection V is to be set up from network node N_1 to network node N_4. According to the invention, a sequential hunt is now started from a bit-rate-dependent starting position if a connection setup request is present. The corresponding conditions are shown in Figure 2.

For this purpose, the two known hunting algorithms, called hunting strategy methods in the text which follows, are combined. Firstly, a criterion is established for when which one of the known hunting strategy methods will be run. The criterion provided is a bit rate threshold value which can be arbitrarily predetermined but should usually be of the order of magnitude $1/10\ C_s \ldots 1/5\ C_s$. Firstly, it is decided in a first step whether the peak bit rate R_p of the connection newly to be accepted is greater than or less than this bit rate threshold value.

If the peak bit rate R_{pV} (j=V) of the connection V newly to be accepted is greater than the bit rate threshold value, the hunting strategy method of the sequential hunt from the fixed zero position is used. It must be assumed, therefore, that this connection is a high-bit-rate connection.

The hunting process is thus started with the first trunk in the trunk group. Which one of the trunks is the first one can be freely defined. The new connection V to be accommodated is accepted if a trunk T_i is found, the freely available residual transmission capacity $C_r(T_i)$ of which is greater than or equal to the peak bit rate R_{pV} of this connection. In this process, the trunks in the trunk group are checked successively step by step. Once a suitable trunk has been found, this trunk is taken and the hunting is terminated. If no free transmission capacity is found by the last trunk, the connection

in question is rejected. If a further connection V' is provided for acceptance at a later time, another hunt is started. This will only be started again at the first trunk if the peak bit rate $R_{pV'}$ of the connection to be newly accepted is greater than the bit rate threshold value.

If the peak bit rate R_{pV} of the connection V to be newly accepted is less than or equal to the bit rate threshold value, the hunting strategy method of the sequential hunt from a variable zero position is used. It must thus be assumed that this connection is a low-bit-rate connection.

The hunting is thus started with a marked trunk in the trunk group. The marking has been performed by the immediately preceding hunt. The new connection to be accommodated is accepted if a trunk T_i is found, the freely available residual transmission capacity $C_r(T_i)$ of which is greater than or equal to the peak bit rate of this connection. If this is so, the hunt is terminated. At the same time as this, the trunk immediately following this is marked. The next hunt is started at this trunk. If no free transmission capacity is found by the last trunk the connection in question is rejected. In this context, the trunk which is arranged immediately preceding the marked trunk after a cyclic rotation is defined as the last trunk.

The present exemplary embodiment generally discussed connections. These can be connections of any type. Thus connections which transmit information in accordance with a synchronous transfer method (STM) can be set up in accordance with the method according to the invention

as can connections which transmit information in accordance with asynchronous transfer method (ATM).

Patent claims

1. A method for determining a communication path in a communication network, comprising

a plurality of connections which are in each case conducted via a further plurality of trunks ($T_1 \ldots T_n$) between two neighboring network nodes ($N_1 \ldots N_4$) and which reserve transmission capacities on these trunks ($T_1 \ldots T_n$), and comprising

at least one further connection (V) which is to be additionally accommodated on one of the trunks ($T_1 \ldots T_n$) in that a hunting algorithm determines the trunk ($T_1 \ldots T_n$) on which this connection (V) can still be accommodated in accordance with an acceptance criterion,

characterized in that

in accordance with a bit rate threshold value, the hunting algorithm is started from a fixed or a variable reference point and is applied step by step to the further plurality of trunks ($T_1 \ldots T_n$) until a trunk ($T_1 \ldots T_n$) having sufficient free transmission capacity is found and the connection is accepted, or all trunks ($T_1 \ldots T_n$) have been checked and the connection must be rejected.

2. The method as claimed in claim 1, characterized in that the fixed reference point is the first trunk (T_1) in the trunk group (TG).

3. The method as claimed in claim 1, characterized in that the variable reference point is the trunk (T_i) in the trunk group (TG) which, in cyclic rotation, is arranged immediately following the trunk at which the hunting algorithm started from a variable reference point has been terminated the last time previously.

4. The method as claimed in claim 1 to 3, characterized in that the free residual transmission capacity ($C_r(T_i)$) of a trunk ($T_1 \ldots T_n$) is obtained from the physical transmission capacity (C_s) of this trunk, and this amount is reduced by the sum of the peak bit rates (R_{pj}) of the currently active m connections ($j=1 \ldots m$) of this trunk.

5. The method as claimed in one of the preceding claims, characterized in that the acceptance criterion is designed in such a manner that a check is made whether the freely available residual transmission capacity $C_r(T_i)$ is greater than or equal to the peak bit rate (R_{pv}) of this connection (V).

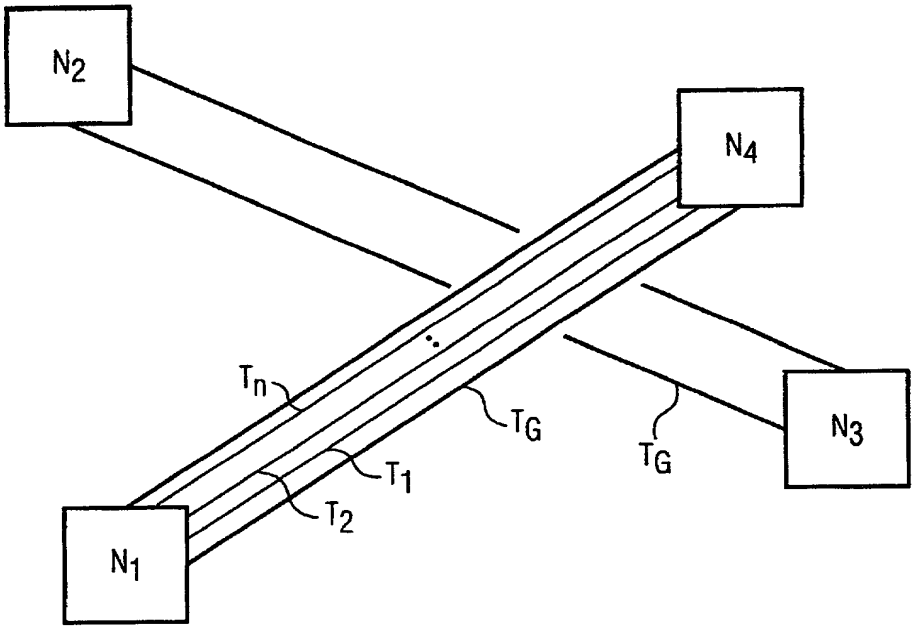
Abstract

Method for determining a communication path in a communication network between two neighboring network nodes.

To allow a connection on a trunk group consisting of a number of trunks between two neighboring network nodes, a hunting algorithm must determine the trunk on which the peak bit rate of this connection can still be accommodated. For this purpose, a bit rate threshold value is first used for deciding whether the hunting algorithm is started from a fixed reference point or from a variable reference point. The hunting algorithm is then applied step by step to the trunks until a trunk having sufficient free transmission capacity is found or the connection must be rejected.

Figure 2

FIG 1



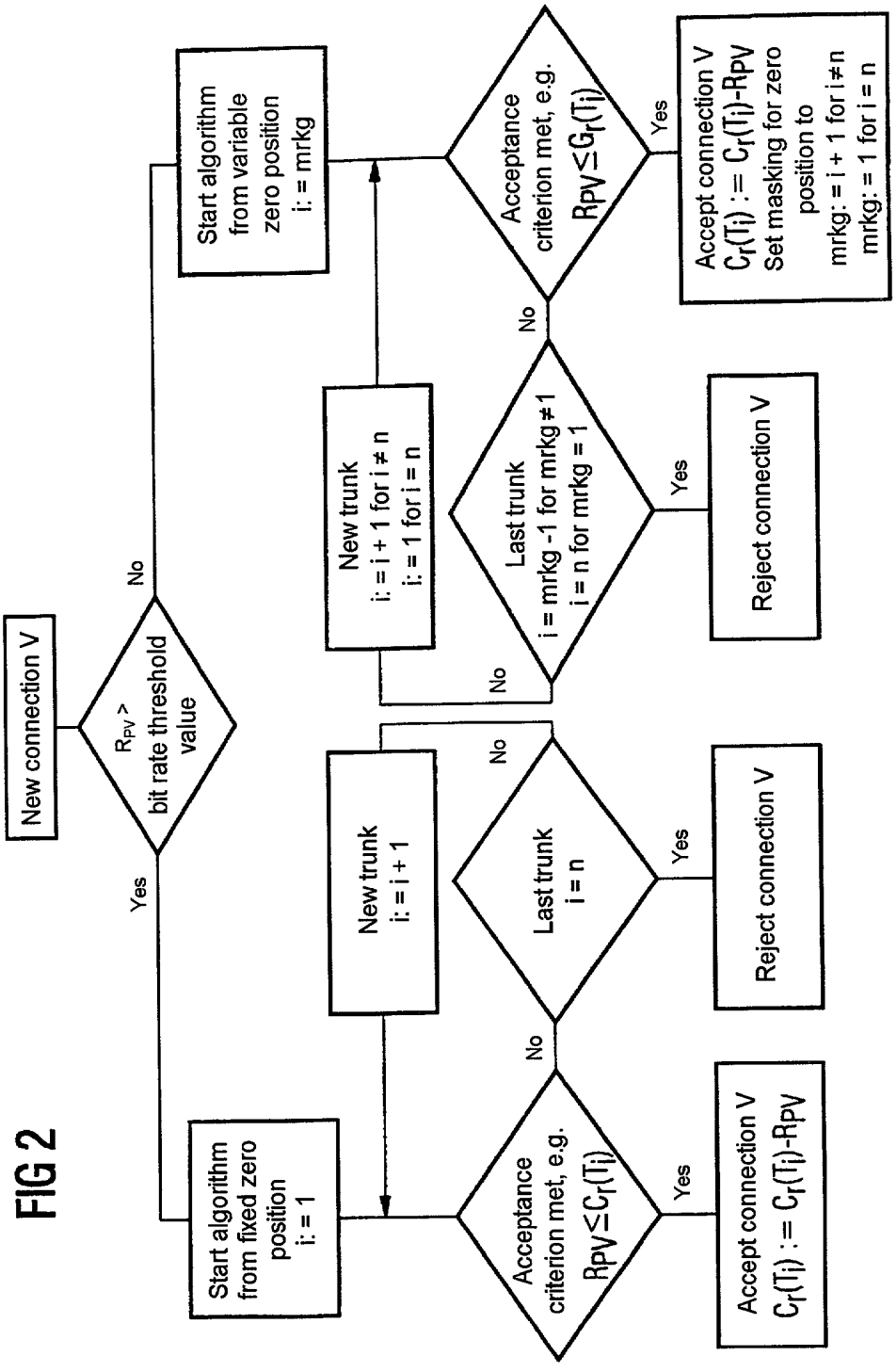

New connection V
R_{PV} > bit rate threshold value
No
Yes
Start algorithm from fixed zero position i: = 1
Start algorithm from variable zero position i: = mrkg
Acceptance criterion met, e.g. $R_{PV} \leq C_r(T_i)$
Yes
No
Accept connection V $C_r(T_i) := C_r(T_i) - R_{PV}$
Last trunk i = n
Yes
No
Reject connection V
New trunk i: = i + 1
Acceptance criterion met, e.g. $R_{PV} \leq G_r(T_i)$
Yes
No
Accept connection V $C_r(T_i) := C_r(T_i) - R_{PV}$ Set masking for zero position to mrkg: = i + 1 for i ≠ n mrkg: = 1 for i = n
Last trunk i = mrkg -1 for mrkg ≠ 1 i = n for mrkg = 1
Yes
No
Reject connection V
New trunk i: = i + 1 for i ≠ n i: = 1 for i = n

FIG 2

German Language Declaration

Prior foreign appplications Priorität beansprucht			Priority Claimed	
19907924.2	DE	24.02.1999	☒	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein
			☐	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein
			☐	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozeßordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

I hereby claim the benefit under Title 35. United States Code. §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §122, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occured between the filing date of the prior application and the national or PCT international filing date of this application.

PCT/DE00/00316 (Application Serial No.) (Anmeldeseriennummer)	02.02.2000 (Filing Date D, M, Y) (Anmeldedatum T, M, J)	anhängig (Status) (patentiert, anhängig, aufgegeben)	pending (Status) (patented, pending, abandoned)
_____ (Application Serial No.) (Anmeldeseriennummer)	(Filing Date D,M,Y) (Anmeldedatum T, M; J)	_____ (Status) (patentiert, anhängig, aufgeben)	(Status) (patented, pending, abandoned)

Ich erkläre hiermit, dass alle von mir in der vorliegenden Erklärung gemachten Angaben nach meinem besten Wissen und Gewissen der vollen Wahrheit entsprechen, und dass ich diese eidesstattliche Erklärung in Kenntnis dessen abgebe, dass wissentlich und vorsätzlich falsche Angaben gemäss Paragraph 1001, Absatz 18 der Zivilprozessordnung der Vereinigten Staaten von Amerika mit Geldstrafe belegt und/oder Gefängnis bestraft werden koennen, und dass derartig wissentlich und vorsätzlich falsche Angaben die Gültigkeit der vorliegenden Patentanmeldung oder eines darauf erteilten Patentes gefährden können.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Declaration and Power of Attorney For Patent Application
Erklärung Für Patentanmeldungen Mit Vollmacht
German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

As a below named inventor, I hereby declare that:

dass mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

My residence, post office address and citizenship are as stated below next to my name,

dass ich, nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel:

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Verfahren zum Ermitteln eines Verbindungsweges in einem Kommunikationsnetz zwischen zwei benachbarten Netzknoten

Method for determining a communication path in a communication network between two neighboring network nodes

deren Beschreibung

(zutreffendes ankreuzen)
☐ hier beigefügt ist.
☒ am 02.02.2000 als
PCT internationale Anmeldung
PCT Anmeldungsnummer PCT/DE00/00316
eingereicht wurde und am ______
abgeändert wurde (falls tatsächlich abgeändert).

the specification of which

(check one)
☐ is attached hereto.
☒ was filed on 02.02.2000 as
PCT international application
PCT Application No. PCT/DE00/00316
and was amended on ______
(if applicable)

Ich bestätige hiermit, dass ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag wie oben erwähnt abgeändert wurde.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) von Wichtigkeit sind, an.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

IDNR: 2590 / V: 99-1.00 / B:Val

German Language Declaration

VERTRETUNGSVOLLMACHT: Als benannter Erfinder beauftrage ich hiermit den nachstehend benannten Patentanwalt (oder die nachstehend benannten Patentanwälte) und/oder Patent-Agenten mit der Verfolgung der vorliegenden Patentanmeldung sowie mit der Abwicklung aller damit verbundenen Geschäfte vor dem Patent- und Warenzeichenamt: *(Name und Registrationsnummer anführen)*

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

And I hereby appoint

Customer No. 25227

Telefongespräche bitte richten an: *(Name und Telefonnummer)*

Direct Telephone Calls to: *(name and telephone number)*

Ext. _____

Postanschrift:

Send Correspondence to:

Morrison and Foerster LLP
2000 Pennsylvania Ave., NW 20006-1888 Washington, DC
Telephone: (001) 202 887 1500 and Facsimile (001) 202 887 0763
or
Customer No. 25227

Voller Name des einzigen oder ursprünglichen Erfinders:	Full name of sole or first inventor:
CLEMENS HAUBER	CLEMENS HAUBER
Unterschrift des Erfinders Datum: Clemens Hauber 03. July 2001	Inventor's signature Date
Wohnsitz: MUENCHEN, DEUTSCHLAND	Residence: MUENCHEN, GERMANY DEX
Staatsangehörigkeit: DE	Citizenship: DE
Postanschrift: BLEIBTREUSTR.19 D 81479 MUENCHEN	Post Office Addess: BLEIBTREUSTR.19 D 81479 MUENCHEN
Voller Name des zweiten Miterfinders (falls zutreffend):	Full name of second joint inventor, if any:
Unterschrift des Erfinders Datum	Second Inventor's signature Date
Wohnsitz ,	Residence ,
Staatsangehörigkeit	Citizenship
Postanschrift	Post Office Address

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).